

WHAT IS CLAIMED IS:

1. A rotor for a synchronous machine comprising  
a cylindrical magnetic solid rotor core;  
a race-track super-conducting coil winding  
extending around the rotor core;  
a coil support extending through the core  
and attaching to opposite long sides of the coil  
winding, and  
a pair of end shafts extending axially from  
said core and attached to the core.
2. A rotor as in claim 1 wherein the rotor core  
includes a pair of flat surfaces formed on opposite  
long sides of the rotor core, and said long sides of  
the coil winding are adjacent the flat surfaces.
3. A rotor as in claim 2 wherein the rotor core  
includes conduits extending between the flat  
surfaces, and further comprising a coil support  
system extending through the conduits to support the  
coil winding.
4. A rotor as in claim 1 wherein the coil  
support system and coil are at cryogenic  
temperatures, and the coil support system is  
thermally isolated from the rotor core.
5. A rotor as in claim 4 wherein an insulating  
tube inserted in the rotor core separates the coil  
support from the core.
6. A rotor as in claim 1 wherein the end shafts  
are a non-magnetic metal.

7. A rotor as in claim 6 wherein the end shafts are stainless steel.

8. A rotor as in claim 1 wherein the rotor core is a solid magnetic iron forging.

9. A rotor as in claim 1 wherein the coil has a race-track shape.

10. A rotor as in claim 1 further comprising a conductive shield around the rotor core and coil.

11. A rotor as in claim 1 wherein one of said end shafts is a collector end shaft having collector rings and a cryogenic fluid coupling.

12. A method for assembling a high temperature super-conducting rotor having a coil winding on a solid iron rotor core of a synchronous machine comprising the steps of:

- a. extending a tension bar through a conduit in said rotor core, wherein said conduit extends between opposite planer sections on long sides of the core;
- b. inserting a housing over a portion of the coil;
- c. attaching an end of the tension bar to the housing, and
- d. attaching rotor end shafts to opposite ends of the rotor core.

13. A method as in claim 12 further comprising covering the core with a conductive shield.

14. A method as in claim 12 further comprising coupling a source of cryogenic cooling fluid to a first end shaft having a cryogenic coupling.

15. A method as in claim 12 wherein each end shaft includes a collar having and a collar slot, and further comprising attaching the collar to an end of the core such that an end of the coil fits in the collar slot.

16. A method as in claim 12 wherein steps (a) to (h) are performed sequentially and in order.

17. In a synchronous machine, a rotor comprising:

a cylindrical rotor core having a pair of planer sections on opposite sides of the core and extending longitudinally along the core;

a super-conducting coil winding extending around at least a portion of the rotor core, said coil winding having a pair of side sections adjacent said planer sections of the core;

a first end shaft extending axially from a first end of the rotor core, and

a second end shaft extending axially from a second end of the rotor core.

18. In a rotor as in claim 17 wherein the first end shaft includes a cryogenic coupling for providing cooling fluid to said coil winding.

19. In a rotor as in claim 17 further comprising a coil support including at least one tension rod extending through the core and attaching to coil

housings at opposite ends of the rod, wherein each coil housing wraps around one of the side sections of the coil.

20. A rotor as in claim 19 wherein the coil support and coil are at cryogenic temperatures, and the coil support is thermally isolated from the rotor core.

21. A rotor as in claim 20 wherein an insulating tube inserted in the rotor core separates the tension rod from the core.

22. A rotor as in claim 17 wherein the end shafts are a non-magnetic metal.

23. A rotor as in claim 22 wherein the end shafts are stainless steel.

24. A rotor as in claim 17 wherein the rotor core is a solid magnetic iron forging.

25. A rotor as in claim 17 wherein the coil has a race-track shape.

26. A rotor as in claim 17 further comprising a conductive shield around the rotor core and coil.

27. A rotor as in claim 17 wherein one of said end shafts is a collector end shaft having collector rings and a cryogenic fluid coupling.